

Claims

- [c1] A communication system, comprising:
- a first interconnecting apparatus connected to an external network, said first interconnecting apparatus comprising a first interconnecting unit operable to receive a first management command from the external network;
 - a second interconnecting apparatus connected to said first interconnecting apparatus; and
 - a first management apparatus, connected to both said first interconnecting apparatus and said second interconnecting apparatus, said first management apparatus comprising a first management command receive unit operable to receive the first management command from said first interconnecting apparatus, the first management command including an instruction for management of said second interconnecting apparatus.
- [c2] A communication system as claimed in claim 1, wherein said second interconnecting apparatus comprises a second interconnecting unit connecting to said first interconnecting apparatus through a first transmission medium and to another apparatus through a second transmission medium which is different from said first transmission medium in a physical layer.
- [c3] A communication system as claimed in claim 1, wherein said second interconnecting apparatus comprises:
- a second interconnecting unit connecting to said first communication apparatus through a first transmission medium and to another apparatus through a second transmission medium; and
 - a first interconnection prohibit unit connecting to said second interconnecting unit, said first interconnecting prohibit unit operating said second interconnecting unit to disconnect transmission both to said first transmission medium and to said second transmission medium when transmission from either said first transmission medium or said second transmission medium is disconnected.
- [c4] A communication system as claimed in claim 3, wherein said first management apparatus comprises:

a monitoring unit, operable to monitor communication between said first interconnecting apparatus and said second interconnecting apparatus if it is disconnected;

an interconnection resume unit operable to release the disconnection of the transmission to said second transmission medium by said first interconnection prohibit unit of said second interconnecting apparatus when communication between said first interconnecting apparatus and said second interconnecting apparatus is disconnected;

a management message transmit unit 570 operable, in a case where said interconnection resume unit releases the disconnection of the transmission to said second transmission medium by said first interconnection prohibit unit, to transmit a communication status get message, that is sent to a communication device connected to said second interconnecting apparatus via said second transmission medium, for getting a communication status of said communication device; and

a reply message receive unit operable to receive, from said communication device, a communication status reply message that is a reply to said communication status get message.

[c5]

A communication system as claimed in claim 4, wherein said management message transmit unit transmits said communication status get message to said second interconnecting apparatus, and said second interconnecting apparatus transmits said communication status get message, received from said management message transmit unit, to said communication device.

[c6]

A communication system as claimed in claim 4, wherein said second interconnecting apparatus includes a second interconnecting unit operable to perform medium conversion between a first transmission medium and a second transmission medium, said first transmission medium being used for connection with said first interconnecting apparatus and said second transmission medium being different from said first transmission medium in a physical layer;

said management message transmit unit transmits said communication status get message to said first interconnecting apparatus,

said first interconnecting unit in said first interconnecting apparatus transmits said communication status get message, received from said management message transmit unit, to said second interconnecting apparatus, and said second interconnecting unit in said second interconnecting apparatus transmits said communication status get message, received from said first interconnecting unit, to said communication device.

[c7]

A communication system as claimed in claim 1, further comprising:

a third interconnecting apparatus connected to said second interconnecting apparatus; and

a second management apparatus, connected to said first management apparatus, operable to manage said third interconnecting apparatus, said second management apparatus comprising a second management command receive unit operable to receive, from said first management apparatus, a second management command for managing said third interconnecting apparatus.

[c8]

A communication system as claimed in claim 7, wherein said second

interconnecting apparatus includes a second interconnecting unit operable to perform medium conversion between a first transmission medium, used for connection with said first interconnecting apparatus, and a second transmission medium, different from said first transmission medium in a physical layer, and said third interconnecting apparatus includes a third interconnecting unit operable to perform medium conversion between said second transmission medium, used for connection with said second interconnecting apparatus, and a third transmission medium, different from said second transmission medium in a physical layer.

[c9]

A communication system as claimed in claim 2, further comprising:

a third interconnecting apparatus, connected to said second interconnecting apparatus, operable to perform medium conversion between said second transmission medium, used for connection with said second interconnecting apparatus, and a third transmission medium, different from said second transmission medium in a physical layer, wherein

said third interconnecting apparatus comprises:

an interconnection prohibit unit operable, in a case where transmission receiving from said second transmission medium or said third transmission medium is disconnected, to disconnect transmission to said second transmission medium and said third transmission medium;

a management message receive unit operable to receive, from said second transmission medium, a communication status get message for getting a communication status of a communication path including said second transmission medium, said third interconnecting apparatus and said third transmission medium;

a management message convert unit operable to change a part of said communication status get message to information indicating a communication status of said third interconnecting apparatus, to generate a communication status reply message having a same length as said communication status get message; and

a management message reply unit operable, when said interconnection prohibit unit disconnects the transmission to said third transmission medium, to transmit said communication status reply message, via said second transmission medium, to said first management apparatus.

[c10]

A communication system as claimed in claim 9, wherein said communication status get message is an echo message in Internet Control Message Protocol (ICMP), said communication status reply message is an echo reply message in ICMP, and said management message convert unit changes said echo message to said information indicating said communication status of said third interconnecting apparatus by interchanging a source IP address and a destination IP address in an IP header of said echo message.

[c11]

An interconnecting apparatus for connecting a first transmission medium and a second transmission medium to each other, comprising:

an interconnection prohibit unit operable to disconnect transmission to said second transmission medium when a predetermined condition is satisfied;

a management message receive unit operable to receive, via said first transmission medium, a communication status get message for getting a

communication status of a communication path including said first transmission medium, said interconnecting apparatus and said second transmission medium; a management message convert unit operable to change a part of fields of said communication status get message to information indicating a communication status of said interconnecting apparatus to generate a communication status reply message having a same length as said communication status get message; and a management message reply unit operable to send back said communication status reply message, via said first transmission medium, when the transmission to said second transmission medium is disconnected.

[c12] An interconnecting apparatus as claimed in claim 11, wherein said second transmission medium is different from said first transmission medium in a physical layer, and said interconnecting apparatus further includes an interconnecting unit operable to perform medium conversion between said first transmission medium and said second transmission medium.

[c13] An interconnecting apparatus as claimed in claim 11, wherein said communication status get message is an echo message in Internet Control Message Protocol (ICMP), said communication status reply message is an echo reply message in ICMP, and said management message convert unit changes said part of said fields of said echo message, as said communication status get message, to said information indicating said communication status of said interconnecting apparatus by interchanging a source IP address and a destination IP address in an IP header of said echo message.

[c14] A communication system management method for managing a communication system having a first interconnecting apparatus connected to an external network; a second interconnecting apparatus connected to said first interconnecting apparatus; and a management apparatus operable to manage said second interconnecting apparatus, said management apparatus being connected to said first interconnecting apparatus and said second interconnecting apparatus, the method comprising: receiving, by said first interconnecting apparatus, a management command, as

an instruction for management of said second interconnecting apparatus, said management command originating from said external network, and transmitting said management command to said management apparatus; receiving, by said management apparatus, said management command transmitted by said first interconnecting apparatus; and managing, by said management apparatus, said second interconnecting apparatus in accordance with said management command.

[c15]

An interconnecting apparatus controlling method for controlling an interconnecting apparatus that connects a first transmission medium and a second transmission medium to each other, said method comprising: disconnecting transmission to said second transmission medium when a predetermined condition is satisfied; receiving, via said first transmission medium, a communication status get message for getting a communication status of a communication path including said first transmission medium, said interconnecting apparatus and said second transmission medium; changing a part of fields of said communication status get message to information indicating a communication status of said interconnecting apparatus to generate a communication status reply message having a same length as said communication status get message; and sending back said communication status reply message, via said first transmission medium, when the transmission to said second transmission medium is disconnected.

[c16]

A program for a management apparatus in a communication system including a first interconnecting apparatus connected to an external network and a second interconnecting apparatus connected to said first interconnecting apparatus, said management apparatus being operable to manage said second interconnecting apparatus, wherein said second interconnecting apparatus includes: an interconnecting unit operable to interconnect communication between a first transmission medium, used for connection with said first interconnecting apparatus, and a second transmission medium; and an interconnection prohibit unit operable to disconnect transmission to said first

transmission medium and said second transmission medium by said interconnecting unit, in a case where transmission receiving from said first transmission medium or said second transmission medium is disconnected, wherein said program comprises:

- a monitoring unit operable to monitor whether or not communication between said first interconnecting apparatus and said second interconnecting apparatus is disconnected;
- an interconnection resume unit operable, in a case where the communication between said first interconnecting apparatus and said second interconnecting apparatus is disconnected, to release the disconnection of transmission to said second transmission medium by said interconnection prohibit unit;
- a management message transmit unit operable, in a case where said interconnection resume unit releases the disconnection of transmission to said second transmission medium by said interconnection prohibit unit, to transmit a communication status get message, for getting a communication status of a communication device connected to said second interconnecting apparatus via said second transmission medium, to be sent to said communication device;
- and
- a reply message receive unit operable to receive a communication status reply message, as a reply to said communication status get message, from said communication device.

[c17]

A recording medium having a program stored therein for use with a management apparatus in a communication system including a first interconnecting apparatus connected to an external network and a second interconnecting apparatus connected to said first interconnecting apparatus, said management apparatus being operable to manage said second interconnecting apparatus, wherein said second interconnecting apparatus includes: an interconnecting unit operable to interconnect communication between a first transmission medium, used for connection with said first interconnecting apparatus, and a second transmission medium; and an interconnection prohibit unit operable to disconnect transmission to said first transmission medium and said second transmission medium by said

interconnecting unit, in a case where transmission receiving from said first transmission medium or said second transmission medium is disconnected, wherein said program comprises:

a monitoring unit operable to monitor whether or not communication between said first interconnecting apparatus and said second interconnecting apparatus is disconnected;

an interconnection resume unit operable to release the disconnection of the transmission to said second transmission medium by said interconnection prohibit unit, in a case where communication between said first interconnecting apparatus and said second interconnecting apparatus is disconnected;

a management message transmit unit operable to transmit a communication status get message, for getting a communication status of a communication device connected to said second interconnecting apparatus via said second transmission medium, to be sent to said communication device, in a case where said interconnection resume unit released the disconnection of the transmission to said second transmission medium by said interconnection prohibit unit; and a reply message receive unit operable to receive a communication status reply message, that is a reply to said communication status get message, from said communication device.